June 16, 2010

Dr. Gunter Kegel
Director - Radiation Laboratory
University of Massachusetts - Lowell
One University Avenue
Lowell, MA 01854

SUBJECT: UNIVERSITY OF MASSACHUSETTS LOWELL – NRC ANNOUNCED ROUTINE INSPECTION REPORT NO. 50-223/2010-201

Dear Dr. Kegel:

The U.S. Nuclear Regulatory Commission (NRC) inspection conducted on May 24 to 27, 2010, at the University of Massachusetts Lowell Research Reactor Facility (Inspection Report No. 50-223/2010-201). The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection. Areas examined during the inspection are identified in the enclosed report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, no safety concern or noncompliance of NRC requirements was identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390 "Public inspections, exemptions and requests for withholding," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Jack Donohue at 301-452-1950 or email at Jack.Donohue@nrc.gov.

Sincerely,

/RA By Patrick Isaac Acting For/
Johnny H. Eads, Jr., Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-223
License No. R-125

Enclosure: As stated

cc: w/encl: See next page

cc:

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Reactor Supervisor
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Department of Environmental Protection
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Massachusetts Emergency Management Agency
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Framingham, MA 01702-5399

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No:	50-223
License No:	R-125
Report No:	50-223/2010-201
Licensee:	University of Massachusetts
Facility:	University of Massachusetts – Lowell Research Reactor
Location:	Lowell, Massachusetts
Dates:	May 24-27, 2010
Inspector:	Jack Donohue
Approved by:	Johnny H. Eads, Jr., Chief Research and Test Reactors Oversight Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Massachusetts - Lowell
Research Reactor Facility
NRC Inspection Report No.: 50-223/2010-201

This routine, announced inspection included on-site review of the University of Masachusetts Lowell (the licensee's) programs concerning organization and staffing, committee audits and reviews, procedures, requalification training for reactor operators; experiments; health physics; effluents and environmental monitoring; emergency planning; and transportation of radioactive material. Specific findings in each of these areas include:

Organization and Staffing Organization and Staffing

- The licensee's organization and staffing were in compliance with the requirements of the license. Records confirmed that shift staffing met the minimum requirements for duty and on-call personnel.

Committees, Audits, and Reviews

- The Reactor Safety Subcommittee provided the oversight required by the Technical Specifications.

Procedures

- The licensee was maintaining and implementing written procedures in accordance with license requirements

Requalification Training

- Operator requalification was conducted as required by the Requalification Program and Title 10 of the *Code of Federal Regulations* Part 55.

Experiments

- Experiments appeared to be reviewed and performed in accordance with Technical Specification requirements and the licensee's written procedures.

Health Physics

- The inspector verified that the licensee's radiation safety program was effective in minimizing radiation doses to individuals through as low as reasonably achievable actions, training, notices to workers, radiation monitoring and surveys, and calibrated equipment.

Effluents and Environmental Monitoring

- Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

Emergency Planning

- Emergency preparations were in accordance with the Emergency Preparedness Plan and regulatory requirements.

Transportation

- Radioactive material shipments were made according to procedures and regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The one megawatt University of Massachusetts - Lowell Research Reactor (UMLRR) had been operated in support of educational experiments and demonstrations, research and service irradiations, reactor operator training, and periodic equipment surveillances. The university of Massachusetts Lowell (UML, the licensee) reported annual operation of 169 critical hours and 38 megawatt hours. The information detailed below was gathered by the inspector through personal observations when touring the facility, observations of specific tasks and evolutions, discussions with members of the licensee's staff, and review of records.

1. Organization and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69001-02.01)

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Technical Specifications (TS) Section 6.1, Organization and Management, were being met:

- UML Radiation Laboratory Organizational Chart, Revision (Rev.) September 12, 2009
- Reactor Console Logbook #29, June 29, 2007 to August 3, 2009 and Reactor Console Logbook #30, August 3, 2009 to present

b. Observations and Findings

The licensee reported that one operations person who held a U. S. Nuclear Regulatory Commission (NRC) Senior Reactor Operator (SRO) license had left the facility since the last inspection and two students are presently in training for a Reactor Operator (RO) examination scheduled in July. Licensed operators consisted of four part-time, (one SRO) and two students holding a SRO license and one student holding a RO license and two full time employees with a SRO license.

In addition to the ROs identified above, one part time employee and one full time employee were qualified as operators for the cobalt-60 irradiator which was in the reactor pool, licensed as part of the R-125 reactor license.

The Inspector, in discussion with the licensee, noted that the new organization chart (9/12/09) indicated two Radiation Laboratory Directors (Co-Directors) assigned to the facility that appeared to share equal responsibility and overall direction to the UMLRR staff. The inspector stated that the issued operating license is directed to the responsible individual (Director) in the initial and reissue of the renewal as well in TS Section 6.1.1, Chart 6-1 TS. The licensee agreed

with the assessment and acknowledged that the individual acting as co-director was only during times of the Directors unavailability.

The minimum staffing required at the reactor and on-call when the reactor is not secured was specified in TS 6.1.4 and 6.1.5. The inspector reviewed the console logbook for the past year and determined that staffing requirements had been met.

c. Conclusion

The licensee's organization and staffing were in compliance with the requirements of the license. Records confirmed that shift staffing met the minimum requirements for duty and on-call personnel.

2. Committees, Audits, and Reviews

a. Inspection Scope (IP 69001-02.09)

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 6.2, Review and Audit, were being completed:

- Reactor Safety Subcommittee (RSSC) Meeting Minutes for meetings of March 11, 2010, December 15, 2009, September 24, 2009, June 24, 2009 and March 30, 2009.
- 2009 Radiation Safety Audit, dated May 20, 2010

b. Observations and Findings

The inspector verified that the composition of the RSSC was as specified in the TS, quorums were present at meetings, meetings were held at the required frequency, and meeting minutes were published in accordance with TS requirements. A review of records indicated that the RSSC provided the oversight and reviews of the reactor programs as required by the TS. The inspector reviewed RSO audit and verified findings were within TS requirements

c. Conclusion

The RSSC provided the oversight required by the TS.

3. Requalification Training

a. Inspection Scope (Inspection Procedures (IP) 69001-02.04 and 92701)

The inspector reviewed the following to verify that the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 55, Operators' Licenses, and the licensee's Requalification Program were being met:

- Requalification Program for Licensed Reactor Operators and Licensed Senior Reactor Operators, September 18, 2008
- Training Record binder, 2002-2010
- Training and Requalification file
- Operator Requalification Audits file
- Written Examination administered April 20, 2010
- Reactor Console Logbook #29, June 29, 2007 to August 3, 2009
- Reactor Console Logbook #30, August 3, 2009 to present
- Individual RO and SRO files

b. Observations and Findings

The inspector reviewed the recently approved Requalification Plan and determined that that the plan was consistent with the 10 CFR Part 55 requirements relative to medical examinations. The inspector reviewed the files of one RO and three SROs, verifying certification of Medical Examination by a designated medical examiner that is conversant with American National Standards Institute/American Nuclear Society (ANSI/ANS)-15.4. Facility Licensee and supporting medical records were on file.

The licensee's requalification program included the regulatory requirement for an annual operating test and a biennial written examination. The inspector verified that both examinations were administered at the required frequency and that the level of difficulty was comparable to that of NRC-administered examinations. The inspector also verified that information about facility and procedural changes had been routed to licensed operators in accordance with the written Requalification Program.

Record of reactor manipulations performed by each operator and internal audit records clearly demonstrated that operators had met those minimum requirements specified in the Requalification Program.

UML Requalification Program Section 4.5.4 requires review of emergency operating procedures (EOP's) annually. Documented training confirmed SRO/RO completed reviews for 2009 and partial reviews for 2010.

c. Conclusion

Operator requalification was conducted as required by the Requalification Program and 10 CFR Part 55.

4. Procedures

a. Inspection Scope (IP 69001-02.03)

The inspector reviewed the following to ensure that the requirements of TS Sections 6.2, Review and Audit, and 6.3, Operating Procedures, were being met:

- Procedure AP-1, Control and Distribution, Rev. 1, September 18, 2003
- Procedure AP-2, Procedure Development, Rev. 1, September 18, 2003
- Procedure RO-5, Reactor Operations, Rev. 3, October 12, 2005
- Procedure RO-7, Reactor Checkout, Rev. 1, July 28, 2008
- Procedure AP-6, 10 CFR 50.59 Screening and Evaluation, Rev. 0, December 16, 2009

b. Observations and Findings

The inspector observed that written procedures were used by the RO during startup operations and associated startup tests. The inspector also observed that the licensee maintained written procedures covering the areas specified in TS Section 6.3. A systematic approach was being used to update and reissue procedures in accordance with a written procedure on document control. New procedures and major changes were reviewed and approved by the RSSC as required by TS 6.2, Review and Audit. Minor changes did not require committee approval but were reviewed by the subcommittee; the reviews and approvals were documented in the minutes of RSSC committee meetings. The inspector reviewed the most recent procedures and validated approval by the RSSC and staff personnel training.

c. Conclusion

The licensee was maintaining and implementing written procedures in accordance with license requirements.

5. Experiments

a. Inspection Scope (IP 69001-02.06 and 92701)

The inspector reviewed the following to verify compliance with TS Sections 3.6, Limitations of Experiments, and 6.8, Approval of Experiments:

- Memo from L. Bobek to File, Review of Reactor Experiment Approvals, dated February 14, 2008
- Files of eight experimental approvals currently being used, dated February 19, 1975 to June 14, 2006
- Procedure FP-05, Sample Handling for the Reactor, Rev. 1, dated September 18, 2008
- Procedure RO-4, Addition or Removal of Core Samples, Rev. 6, dated June 14, 2005
- File of Reactor Irradiation Request Forms for 2009 and 2010
- Reactor Console Logbook #29, June 29, 2007 to August 3, 2009
- Reactor Console Logbook #30, August 3, 2009 to present
- Procedure AP-6, 10 CFR 50.59 Screening and Evaluation, Rev. 0, dated December 16, 2009.

b. Observations and Findings

The inspector reviewed eight experiments being used most frequently, consisting of the original approved experiment and other relevant information. This provided a reference from which the RS and RSO could make their determination regarding the envelope of the original safety analysis. The inspector reviewed the file of Reactor Irradiation Request Forms for experiments that had been performed during the past two years, noting that the screening and evaluation process was in place and successfully used by staff personnel. The Reactor Irradiation Request Form clearly indicates what information is required and that the required information is being recorded.

c. Conclusion

Experiments appeared to be reviewed and performed in accordance with TS requirements and the licensee's written procedures.

6. Health Physics

a. Inspection Scope (IP 69001-02.07.a-d & g-p)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and TS Sections 3.4 and 4.3, Radiation Monitoring Equipment, requirements:

- 2009 Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, D. Medich, March 18 to May 20, 2010
- U Mass, Lowell Radiation Safety Guide, January 2008
- Landauer Records of Personnel Dosimetry, 2009, 2010
- Reactor Monthly Radiation Survey file for 2009, 2010
- Health Physics Training for ROs file
- Procedure SP-1, Environmental Radiation Monitoring System Check and Calibration, dated December 11, 2007

b. Observations and Findings

The inspector toured the facility, finding practices regarding the use of dosimetry, radiation monitoring equipment, placement of radiological signs and postings, calibration of radiation monitoring instruments, and the handling and storing of radioactive material or contaminated equipment to be in accordance with regulations and the licensee's written Radiation Safety Guide. The licensee RSO had performed and documented an annual radiation safety audit in assuring effective implementation of As Low As Reasonably Achievable (ALARA) practices, focusing the 2009 audit on activities related to activities licensed under the R-125 reactor license.

The inspector reviewed records of radiation surveys of the reactor facility and found them to be generally low and in line with facility postings and instrument readings. No unmarked radioactive material was found in the facility. A copy of the current NRC Form 3 "Notice to Radiation Workers" as required by 10 CFR Part 19, was posted at numerous places throughout the facility, including the Control Room and entrance to the Reactor Bay.

Dosimetry results were reviewed by the inspector. The licensee used optically stimulated luminescent dosimeters (OSLDs) for personnel whole body monitors and thermal luminescent dosimeters (TLDs) for extremity dosimetry (finger rings) and environmental area monitors. The whole body doses to the 19 individuals designated as reactor radiation workers indicated the highest radiation exposure received was 120 mrem (SDE) for an extremity during 2009. The remaining exposure dose for the remaining reactor personnel was non-detectable. The licensee attributed the low exposure in part to ALARA initiatives.

Radiation monitoring devices were calibrated per written procedures on the frequencies specified in the procedures. The Assistant Radiation Safety Officer (ARSO) calibrated all portable instruments while the reactor operations staff, in consultation with the ARSO calibrated in-line process instrumentation. The licensee did not maintain a respiratory protection program but one is available should the need occur.

The inspector noted from records that training was provided for radiation workers, including examination and a passing grade before being issued dosimetry. The training addressed special considerations of the embryo and fetus, including distribution of Regulatory Guide 8.13 to all female radiation workers.

c. Conclusion

The inspector verified that the licensee's radiation safety program was effective in minimizing radiation doses to individuals through ALARA actions, training, notices to workers, radiation monitoring and surveys, and calibrated equipment.

7. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69001-02.07.e, f, & g)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and TS Sections 3.4 and 4.3, Radiation Monitoring Equipment, requirements regarding effluents, and environmental monitoring:

- U Mass, Lowell 2008-2009 Annual Operating Report,
- 2009 Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, D. Medich, March 18, 2010 to May 20, 2010
- Landauer Records of Personnel Dosimetry, 2009, 2010

- Reactor Monthly Radiation Survey file for 2009, 2010
- Procedure SP-1, Environmental Radiation Monitoring System Check and Calibration, dated December 11, 2007

b. Observation and Findings

The annual report referenced above describes the gaseous, liquid and solid waste generated at the reactor facility during the year 2009. Argon-41 produced by the irradiation of atmospheric air was the only effluent of significance, that being extremely small. The reported 1.72 Curie Argon-41 (46.5 MWH) annual emission from the stack, when using the conservative approximations of Level 4 of the EPA COMPLY code, indicated a dose of less that 0.6 millirem relative to an ALARA goal of less that 10 millirem. The annual liquid effluent to the public sewer system of approximately six µCi's was not detectable in the effluent stream. There were 9,000 gallons of water released an estimated total release of < 1µCi/ml in 2009. There are approximately 73 cubic feet of solid waste generated by the reactor facility. A vendor has been separating and quantifying the material for ultimate disposal.

The licensee placed TLDs around the reactor facility as environmental radiation monitors. In all cases the TLDs indicated no significant difference from background radiation levels.

c. Conclusion

Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

8. Emergency Planning

a. Inspection Scope (IP 69001-02.10)

The inspector reviewed the emergency preparedness program and its implementation through the following:

- Emergency Preparedness Plan for the U Mass, Lowell Research Reactor, Rev. 6, dated August 2007
- Reactor Emergency Drill file (for February 20, 2009 drill)
- Emergency Call List, dated May 10, 2010
- EO-1, Radiation Emergency, dated March 31, 2004

b. Observations and Findings

The inspector reviewed the licensee's implementing procedures for their Emergency Preparedness Program. The plan called for an annual review by the RS and RSO and the inspector verified this was completed. The emergency call list was reviewed periodically to verify its accuracy and the posted call lists were

recently an updated version. The licensee promptly revised surveillance checklists, making the emergency plan review an annual surveillance requirement and the verification of current emergency call list postings a quarterly requirement.

The inspector reviewed the Emergency Equipment Checkout List and determined the surveillance had been completed and that the operational and calibration checks were recorded and in calibration.

The inspector reviewed the file for the last emergency drill and noted that training was offered, a post-drill critique was conducted, and action items were identified and dispositioned.

The inspector visited the campus police and determined their training and knowledge of Emergency Preparedness was appropriate and their personal relationship to UML personnel was well established.

c. Conclusion

Emergency preparations were in accordance with the Emergency Preparedness Plan and regulatory requirements.

9. Transportation

a. Inspection Scope (IP 86740)

The inspector interviewed personnel and reviewed the following to verify compliance with regulatory and procedural requirements for transferring licensed material:

- Procedure HPP-3, Work Instruction, Shipment of Radioactive Material, Rev. B, dated February 5, 2008
- FHPP-3 Radioactive Material Shipment Form, Rev. B and Packaging Slip for shipments on May 7, 2009, May 13, 2009, June 6, 2009, and June 11, 2009

b. Observations and Findings

The RSO/ASRO were responsible for all of the licensee's shipments of radioactive material. However, very few shipments were performed under the reactor license. The inspector reviewed four shipments including depleted uranium sheets (3.2Kg total mass) and three irradiated electronic components shipments tested at the UMLRR for offsite clients.

The inspector, in reviewing the 2009 Radiation Safety Audit, noted a self-reported violation involving a shipment of a radioactive package sent as a normal (unregulated) package. On August 10, 2009, members of the UMLRR shipped

electronic components as a non-radioactive (exempt) package. This package was measured and detected by the receiver at very low levels (2.5 mrad/hr at 2 cm) who then notified UMLRR of their finding. The cause of the occurrence was determined to be UMLRR staff personnel failed to notify the Radiation Safety Office to perform radiation surveys prior to shipment. A change was initiated that requires UMLRR staff personnel to notify the RSO/ARSO to perform radiological surveys prior to shipment. The Reactor Supervisor and all staff personnel have been trained on the new shipping survey requirements.

The inspector inquired whether the NRC had been notified. The RSO stated that the State of Massachusetts, as well as the NRC was notified through the National Materials Events Database (NMED) item No. 090669.

c. Conclusion

Radioactive material shipments were made according to procedures and regulatory requirements.

10. Exit Interview

The inspector reviewed the inspection results with members of licensee management at the conclusion of the inspection on May 27, 2010. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Bobek	Reactor Supervisor
P. Chowdhury	Co-Director Radiation Laboratory
C. French	Professor of Physics and Chairman of the Radiation Safety Committee
D. Medich	Radiation Safety Officer
T. Regan	Chief Reactor Operator
S. Snay	Assistant Radiation Safety Officer
J. White	Professor of Chemical Engineering and Chairman of the Reactor Safety Subcommittee

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Transportation
IP 92701	Follow-up

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

None

PARTIAL LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access and Management System
ALARA	As Low As Reasonably Achievable
ANSI/ANS	American National Standards Institute/Americna Nuclear Society
ARSO	Assistant Radiation Safety Officer
10 CFR	Title 10 of the *Code of Federal Regulations*
EOP	Emergency Operating Procedures
IFI	Inspector Follow-up Item
IP	Inspection Procedure
NRC	U. S. Nuclear Regulatory Commission

OSLD	Optically Stimulated Luminescent Dosimeter
PARS	Publicly Available Records
Rev.	Revision
RO	Reactor Operator
RS	Reactor Supervisor
RSO	Radiation Safety Officer
RSSC	Radiation Safety Subcommittee
SDE	Shallow Dose Equivalent
SRO	Senior Reactor Operator
TLD	Thermoluminescent Dosimeter
TS	Technical Specifications
UML	University of Massachusetts Lowell
UMLRR	University of Massachusetts - Lowell Research Reactor